Amendments to the Specification:

Please replace the paragraph beginning at page 1, line 3 with the following rewritten paragraph:

This application claims priority to U.S. Application No. 09/956,851 entitled "Methods and Systems for Determining a Presence of Macro Defects and Overlay of a Specimen," filed September 20, 2001, which claims priority to U.S. Patent Provisional Application No. 60,234,323 entitled "Methods and Systems for Semiconductor Fabrication Processes," filed September 20, 2000.

Please replace the paragraph beginning at page 64, line 1 with the following rewritten paragraph:

Figs. 2a and 2b illustrate a schematic top view of an embodiment of stage 24 configured to support a specimen. The stage may be a vacuum chuck or an electrostatic chuck. In this manner, a specimen may be held securely in place on the stage. In addition, the stage may be a motorized translation stage, a robotic wafer handler, or any other suitable mechanical device known in the art. In an embodiment, the system may include measurement device 26 coupled to the stage. As such, the stage may be configured to impart relative motion to the specimen with respect to the measurement device. In an example, the stage may be configured to move the specimen relative to the measurement device in a linear direction. The relative motion of the stage may cause an incident beam of energy from an energy source of a measurement device to traverse the surface of the specimen while leaving the angle of incidence at which light strikes the surface of the specimen substantially unchanged. As used herein, the term "measurement device" is generally used to refer to a metrology device, an inspection device, or a combination metrology and inspection device.

Please replace the paragraph beginning at page 65, line 15 with the following rewritten paragraph:

As shown in Fig. 2b, measurement device 30 may be configured to be relatively stationary in a position relative to stage 24. Devices (not shown) including, but not limited to, a deflector such as an acousto-optical deflector ("AOD") within measurement device 30 may be configured to linearly alter a position of an incident beam with respect to the stage. An example of an AOD is illustrated in PCT Application No. WO 01/14925 A1 to Allen et al., and is incorporated by reference as if fully set forth herein. In this manner, the incident beam may ~~be~~ traverse a radius of the stage as the stage is rotating. In addition, by altering a position of an incident beam with respect to the stage using such devices, registry

of the measurement device with a pattern formed on a surface of a specimen may be maintained. The device may be configured to cause an incident beam of energy from an energy source of the measurement device to traverse the surface of the specimen while leaving the angle of incidence at which the beam of energy strikes the surface of the specimen substantially unchanged.

Please replace the paragraph beginning at page 66, line 16 with the following rewritten paragraph:

A measurement device and stage configured, as described above, to control and alter the measurement or inspection location of the specimen may provide several advantages in comparison to currently used systems. For example, currently used systems configured to inspect multiple locations on a specimen may include a stationary measurement device and a stage configured to move laterally in two independent directions. Alternatively, currently used systems may include a stationary stage and a measurement device configured to alter a position of ~~an~~ a beam of energy incident on a specimen by altering a position of two mirrors in a first direction and a position of two mirrors in a second direction. An example of such a system is illustrated in U.S. Patent Nos. 5,517,312 to Finarov and 5,764,365 to Finarov, and are incorporated by reference as if fully set forth herein. An additional system may include a stage configured to rotate and a laser light source configured to move radially. Such a system may be unsuitable for measurement or inspecting a patterned specimen. Additional examples of currently used systems are illustrated in U.S. Patent No. 5,943,122 to Holmes, and is incorporated by reference as if fully set forth herein.

Please replace the paragraph beginning at page 75, line 23 with the following rewritten paragraph:

An extent of overlay misregistration of a specimen may vary depending on, for example, performance characteristics of a lithography process. During lithography, a reticle, or a mask, may be disposed above a resist arranged on a first level of the specimen. The reticle may have substantially transparent regions and substantially opaque regions that may be configured in a pattern, which may be transferred to the resist. The reticle may be positioned above a specimen by an exposure tool configured to detect a position of an alignment mark on the specimen. In this manner, overlay misregistration may be caused by performance limitations of an exposure tool to detect an alignment mark and to alter a position of the reticle with respect to the specimen.

Please replace the paragraph beginning at page 77, line 23 with the following rewritten paragraph:

The photodiode array, therefore, may measure the reflectance spectrum 92 of the light returned from the surface of the specimen. A relative reflectance spectrum may be obtained by dividing the intensity of the returned light of the reflectance spectrum at each wavelength by a relative reference intensity at each wavelength. A relative reflectance spectrum may be used to determine the thickness of various films on the wafer. In addition, the reflectance at a single wavelength and the refractive index of the film may also be determined from the relative reflectance spectrum. Furthermore, a model method by modal expansion ("MMME") model 94 may be used to generate library 96 of various reflectance spectrums. The MMME model is a rigorous diffraction model that may be used to calculate the theoretical diffracted light "fingerprint" from each grating in the parameter space. Alternative models may also be used to calculate the theoretical diffracted light, however, including, but not limited to, a rigorous coupling waveguide analysis ("RCWA") model. The measured reflectance spectrum 92 may be fitted to ~~a~~ the various reflectance spectrums in library 96. The fitted data 97 may be used to determine critical dimension 95 such as a lateral dimension, a height, and a sidewall angle of a feature on the surface of a specimen as described herein. Examples of modeling techniques are illustrated in PCT Application No. WO 99/45340 to Xu et al., and is incorporated by reference as if fully set forth herein.

Please replace the paragraph beginning at page 79, line 14 with the following rewritten paragraph:

The measurement device may also include apodizer 116. Apodizer 116 may have a two dimensional pattern of alternating relatively high transmittance areas and substantially opaque areas. The alternating pattern may have a locally averaged transmittance function such as an apodizing function. As such, an apodizer may be configured to reduce a lateral area of an illuminated region of a specimen to improve a focusing resolution of the measurement device. The measurement device may also include a plurality of mirrors 118 configured to direct light propagating along path 106 to a surface of a specimen. In addition, the measurement device may also include reflecting objective lens 120 configured to direct the light to the surface of the specimen. For example, a suitable reflecting objective may have a numerical aperture ("NA") of approximately 0.1 such that light may be may be directed at a surface of the specimen at high angles of incidence.

Please replace the paragraph beginning at page 81, line 24 with the following rewritten paragraph:

In an embodiment, a measurement device configured as an interference microscope may include ~~a~~ an energy source such as a xenon lamp configured to emit an incident beam of light. An appropriate energy source may also include a light source configured to emit coherent light such as light that may be produced by a laser. The measurement device may further include additional optical components configured to direct the incident beam of light to a surface of the specimen. Appropriate additional optical components may include condenser lenses, filters, diffusers, aperture stops, and field stops. Additional optical components may also include beam splitters, microscopic objectives, and partially transmissive mirrors.

Please replace the paragraph beginning at page 84, line 15 with the following rewritten paragraph:

In an embodiment, measurement device 78 may be configured as a pattern recognition device. Measurement device 78 may include a light source such as a lamp configured to emit broadband light, which may include visible and ultraviolet radiation. The measurement device may also include a beam splitting mirror configured to direct a portion of the light emitted by the light source to an objective thereby forming a sample beam of light. The objective may include reflective objectives having several magnifications. For example, the objective may include a 15x Schwartzchild design all-reflective objective, a 4x Nikon CFN Plan Apochromat, and a 1x UV transmissive objective. The three objectives may be mounted on a turret configured to rotate such that one of the three ~~objective~~ objectives may be placed in a path of the sample beam of light. The objective may be configured to direct the sample beam of light to a surface of a specimen.

Please replace the paragraph beginning at page 86, line 18 with the following rewritten paragraph:

The scatterometer may also include a detection system that may include a spectrometer. The spectrometer may be configured to measure an intensity of different wavelengths of light scattered from a surface of a specimen. In an embodiment, the zeroth diffraction order intensity may be measured. Although for some repeatable pattern features, measurement of higher diffraction order intensities may also be possible. A signal responsive to the zeroth and/or higher diffraction order intensities at different

wavelengths generated by the spectrometer may be sent to a processor coupled to the spectrometer. The processor may be configured to determine a signature of a structure on a surface of the specimen. In addition, the processor may be configured to determine a property of repeatable pattern features on the surface of the specimen. For example, the processor may be further configured to compare the determined signature to signatures of a database. Signatures of the database may include signatures determined experimentally with specimens having known characteristics and/or signatures determined by modeling. A property of a repeatable pattern feature may include a period, a width, a step height, a sidewall angle, a thickness of underlying layers, and a profile of the features on a specimen.

Please replace the paragraph beginning at page 103, line 15 with the following rewritten paragraph:

In an embodiment, system 32 may be configured as an integrated station platform ("ISP") system. ~~An~~ A system may be configured as a stand-alone cluster tool. Alternatively, the ISP system may be coupled to a process tool. Fig. 14 illustrates a perspective view of an embodiment of ISP system 158 that may be arranged laterally proximate and coupled to a semiconductor fabrication process tool such as lithography tool 130. In this manner, ISP system 158 may be configured as a cluster tool coupled to lithography tool 130. For example, as shown in phantom in Fig. 13, ISP system 158 may be coupled to cassette end 160 of lithography tool 130. Fig. 15 further illustrates a perspective view of an embodiment of ISP system 158 coupled to cassette end 160 of lithography tool 130. As further shown in phantom in Fig. 13, ISP system 158 may be also coupled to interface system 152 at exposure tool end 162 of lithography tool 130. ISP system 158 may be further configured as illustrated in U.S. Patent No. 6,208,751 to Almogy, which is incorporated by reference as if fully set forth herein.

Please replace the paragraph beginning at page 109, line 22 with the following rewritten paragraph:

Fig. 17 illustrates a schematic side view of an embodiment of measurement chamber 178 coupled to a process tool such as a semiconductor fabrication process tool. As shown in Fig. 17, measurement chamber 178 may be arranged laterally proximate to process chamber 180 of a process tool. Alternatively, the measurement chamber may be arranged vertically proximate to process chamber 180. For example, the measurement chamber may be arranged above or below process chamber 180. As shown in Fig. 17, process chamber 180 may be a resist apply chamber as described herein. For example, specimen 182 may be disposed upon stage 184. Stage 184 may be configured as a motorized rotating

chuck or any other device known in the art. A resist may be dispensed onto specimen 182 from dispense system 186. Dispense system 186 may be coupled to a resist supply and may include a number of pipes and/or hoses and controls such as valves such that resist may be transferred from the resist supply to specimen 182. The dispense system may also be coupled to a controller computer, which may be configured to control the dispense system. For example, the controller computer may include processor 54 as described herein. Stage 184 may be configured to rotate such that the dispensed resist may spread over specimen 182 and such that solvent may evaporate from the dispensed resist. Process chamber 180, however, may include any of the process chambers as described herein. In addition, measurement chamber 178, process chamber 180, and processor 54 may be arranged in a modular architecture as illustrated in PCT Application No. WO 99/03133 to Mooring et al., which is incorporated by reference as if fully set forth herein.--

Please replace the paragraph beginning at page 110, line 16 with the following rewritten paragraph:

In an embodiment, therefore, specimen 182 may be easily and quickly be moved from process chamber 180 to measurement chamber 178 (or from measurement chamber 178 to process chamber 180) by a robotic wafer handler of a process tool, by a wafer handler of an ISP system, or by stage 42 as described herein. In this manner, system 32 may be configured to determine at least a first property and a second property of the specimen ~~prior~~ between process steps of a process. For example, in a lithography process, first and second properties of a specimen may be determined subsequent to resist apply and prior to exposure. In an additional example, first and second properties of a specimen may be determined subsequent to exposure and prior to post exposure bake. In a further example, first and second properties of a specimen may be determined subsequent to post exposure bake and prior to develop. First and second properties of a specimen may also be determined subsequent to develop. Furthermore, such a system may be configured to determine at least a first property and a second property of the specimen prior to substantially an entire process or subsequent to substantially an entire process. A system configured as described above may also have a relatively short turn-around-time. As described above, therefore, such a system may provide several advantages over currently used metrology and inspection systems.

Please replace the paragraph beginning at page 112, line 24 with the following rewritten paragraph:

Fig. 18 illustrates a schematic side view of an embodiment of system 32 coupled to process chamber 188. The process chamber may be a process chamber coupled to a semiconductor fabrication process tool. Stage 190 may be disposed within process chamber 188. Stage 190 may be configured to support specimen 192, for example, during a semiconductor fabrication process step. System 32 may be coupled to process chamber 188 such that measurement device 34 may be external to process chamber 188 but may be coupled to stage 190 disposed within the process chamber. For example, process chamber 188 ~~include~~ includes one or more relatively small sections 194 of a substantially transparent material disposed within one or more walls of the process chamber. Sections 194 may be configured to transmit a beam of energy from an energy source of the measurement device outside the process chamber to a surface of a specimen within the process chamber. Sections 194 may also be configured to transmit a beam of energy returned from the surface of the specimen to a detector of measurement device 34 outside process chamber 188. The substantially transparent material may have optical or material properties such that the beam of energy from the energy source and the returned beam of energy may pass through sections 194 of the process chamber without undesirably altering the properties of the directed and returned energy beams. For example, undesirably altering the properties of the energy beams may include, but is not limited to, altering a polarization or a wavelength of the energy beams and increasing chromatic aberration of the energy beams. In addition, sections 194 may be configured such that deposition of process residue from a chemical using during processing of a specimen may be reduced as described in PCT Application No. 99/65056 to Grimbergen et al., which is incorporated by reference as if fully set forth herein.

Please replace the paragraph beginning at page 116, line 15 with the following rewritten paragraph:

In a further embodiment, the processor ~~maybe~~ may be configured to compare at least one determined property of the specimen and properties of a plurality of specimens. For example, the plurality of specimens may include product wafers processed prior to the processing of the specimen. At least two properties of the plurality of specimens may be determined prior to processing of the specimen with a system as described herein. The plurality of specimens may also include specimens within the same lot as the specimen or specimens within a different lot than the specimen. As such, the processor may be configured to monitor a process such as a semiconductor fabrication process using a wafer-to-

wafer comparison technique or a lot-to-lot comparison technique. In this manner, the processor may be configured to monitor the performance of the process and to determine if the performance of the process or a process tool is drifting. A method ~~an~~ and apparatus for reducing lot to lot CD variation in semiconductor wafer processing is illustrated in European Patent Application No. EP 1 065 567 A2 to Su, and is incorporated by reference as if fully set forth herein.

Please replace the paragraph beginning at page 117, line 1 with the following rewritten paragraph:

Alternatively, the processor may be configured to compare at least one determined property of the specimen to a predetermined range for at least the one property. The predetermined range may be determined, for example, from design constraints for the specimen. In addition, the predetermined range may be determined by using a statistical process control method to determine an average of at least the one property and additional statistical parameters such as a variance of at least the one property for a process. In addition, the processor may be configured to generate an output signal if at least the one determined property is outside of a predetermined range. The output signal may be a visual signal such as a signal displayed on a monitor coupled to the processor. The monitor may be disposed in a semiconductor fabrication facility such that the displayed signal may be viewed by an operator. Alternatively, the output signal may be any signal known in the art ~~signal~~ such as an audible signal or a plurality of signals.

Please replace the paragraph beginning at page 118, line 4 with the following rewritten paragraph:

In an additional embodiment, the processor may be configured to alter a sampling frequency of a measurement device in response to at least one determined property of a specimen. For example, if a determined property is substantially different than an expected value for the property, or if a determined property is outside of a predetermined range for the property, then the processor may increase the sampling frequency of the measurement device. The sampling frequency may be altered, for example, such that the measurement device is configured to direct and detect energy from an increased number of locations on the specimen. In this manner, the sampling frequency may be altered using an in situ control technique. In addition, the sampling frequency of the measurement device may be altered to determine statistical data of the determined property across the specimen such as an average ~~of the determined~~

~~property across the specimen~~. As such, the determined property may be classified as a random defect, a repeating defect, or as another such defect.

Please replace the paragraph beginning at page 143, line 24 with the following rewritten paragraph:

A system configured to determine at least two properties of a specimen may include measurement device 220 coupled to chemical-mechanical polishing tool 222. The measurement device may be configured according to any of the embodiments described herein. For example, measurement device 220 may be a non-imaging dark field device, a non-imaging bright field device, a non-imaging dark field and bright field device, a double dark field device, a dark field imaging device, a bright field imaging device, a dark field and bright field imaging device, a spectroscopic ellipsometer, a spectroscopic reflectometer, a dual beam spectrophotometer, and a beam profile ellipsometer. In addition, the measurement device may include any combination of the above devices. As such, the measurement device may be configured to function as a single measurement device or as multiple measurement devices. Because multiple measurement devices may be integrated into a single measurement device of the system, optical elements of a first measurement device, for example, may also be optical elements of a second measurement device.

Please replace the paragraph beginning at page 146, line 27 with the following rewritten paragraph:

In an embodiment, a system configured to determine at least a presence of defects on a specimen and a critical dimension of the specimen may be coupled to an etch tool as described herein. The presence of defects may include a presence of defects on a back side of the specimen. In addition, the system may be further configured to determine a number, a location, and/or a type of defects on the specimen. The system may be coupled to the etch tool such that at least a presence of defects on the specimen and a critical dimension of the specimen may be determined prior to and subsequent to an etch process or a step of an etch process. As described herein, at least one of the determined properties may be used to alter a parameter of one or more instruments coupled to a process tool. For example, a determined critical dimension of the specimen may be used to alter a parameter of one or more instruments coupled to a lithography tool using a feedforward control technique or a feedback control technique. In addition, a determined presence of defects on the specimen may be used to alter a

parameter of one or more instruments coupled to the lithography tool using a feedforward control technique ~~of~~ or a feedback control technique.

Please replace the paragraph beginning at page 149, line 8 with the following rewritten paragraph:

In a further embodiment, the measurement chamber may be coupled to and disposed laterally or vertically proximate an exit chamber of a chemical-mechanical polishing tool. An exit chamber of a chemical-mechanical polishing tool may include a water bath configured to receive a specimen subsequent to a chemical-mechanical polishing process. The water bath may be used to remove chemicals, slurry particles, and/or specimen particles remaining on the specimen subsequent to a chemical-mechanical polishing process. In this manner, the system may be configured to determine at least two properties of the specimen, as the specimen is disposed within or moving through the exit chamber.

Please replace the paragraph beginning at page 149, line 18 with the following rewritten paragraph:

In an additional embodiment, the measurement device may be disposed in a measurement chamber, as described with respect to and shown in Fig. 16. The measurement chamber may be coupled to a chemical-mechanical polishing tool, as shown in Fig. 17. For example, the measurement chamber may be disposed laterally or vertically proximate one or more polishing chambers of a chemical-mechanical polishing tool. In addition, the measurement chamber may be disposed laterally or vertically proximate a load chamber of a chemical-mechanical polishing tool. A load chamber of a chemical-mechanical polishing tool may be configured to support multiple ~~specimen~~ specimens such as a cassette of wafers that are to be processed in the chemical-mechanical polishing tool. A robotic wafer handler may be configured to remove a specimen from the load chamber prior to processing and to dispose a processed specimen into the load chamber.

Please replace the paragraph beginning at page 151, line 1 with the following rewritten paragraph:

In an embodiment, a system may be configured to determine at least two properties of a specimen including a presence of macro defects on the specimen and a presence of micro defects on the specimen. The system may be configured as described herein. For example, the system may include a processor coupled to a measurement device. The processor may be configured to determine at least a presence of macro defects and a presence of micro defects on the specimen from one or more output signals generated by the measurement device. In addition, the processor may be configured to determine other properties of the specimen from the one or more output signals. For example, the processor may be configured to determine a presence of subsurface defects such as voids from one or more output signals generated by a measurement device such as an e-beam device, an X-ray reflectometer, or an X-ray fluorescence device. Such voids may be problematic, in particular for copper structures, if the voids fill with chemicals such as plating solutions, which may corrode the metal. In addition, the processor may be configured to determine a thickness of a metal layer such as copper on the specimen from one or more output signals generated by a measurement device such as an X-ray reflectometer and/or an X-ray fluorescence device.

Please replace the paragraph beginning at page 152, line 3 with the following rewritten paragraph:

In an embodiment, the measurement device may include a non-imaging scatterometer, a scatterometer, a spectroscopic scatterometer, a reflectometer, a spectroscopic reflectometer, an ellipsometer, a spectroscopic ellipsometer, a bright field imaging device, a dark field imaging device, a bright field and dark field imaging device, a bright field non-imaging device, a dark field non-imaging device, a bright field and dark field non-imaging device, a double dark field device, a coherence probe microscope, an interference microscope, an optical profilometer, an e-beam device such as a scanning electron microscope or a tunneling electron microscope, an X-ray reflectometer, an X-ray fluorescence device, an optical fluorescence device, an eddy current imaging device, and a relatively large-spot e-beam device, or any combination thereof. For example, an appropriate combination may include an eddy current imaging device and a relatively large-spot e-beam device. An eddy current imaging device may generate one or more output signals that may be used ~~to~~ as a qualitative excursion monitor for a presence of macro defects on a surface of the specimen. The eddy current imaging device may be configured as described herein. A large-spot e-beam device such as a scanning electron microscope may have relatively low resolution and a relatively low data rate. One or more output signals generated by such an e-beam

device may include a voltage contrast that may vary depending upon a presence of defects such as macro defects on the surface of the specimen. An example of an e-beam device is illustrated in U.S. Patent Application entitled "Sectored Magnetic Lens," by John A. Notte IV, filed on June 15, 2001, which is incorporated by reference as if fully set forth herein.

Please replace the paragraph beginning at page 154, line 7 with the following rewritten paragraph:

In an additional embodiment, the measurement device may be disposed in a measurement chamber, as described with respect to and shown in Fig. 16. The measurement chamber may be coupled to the process tool, as shown in Fig. 17. For example, the measurement chamber may be disposed laterally or vertically proximate one or more process chambers of the process tool. For example, the deposition tool may include a cluster of process chambers that may each be configured to perform substantially similar processes or different processes. In addition, the measurement chamber may be disposed laterally or vertically proximate a load chamber of the process tool. A load chamber of a deposition tool may be configured to support multiple ~~specimen~~ specimens such as a cassette of wafers that are to be processed in the process tool. A robotic wafer handler may be configured to remove a specimen from the load chamber prior to processing and to dispose a processed specimen into the load chamber. Furthermore, the measurement chamber may be disposed in other locations proximate a process tool such as anywhere proximate the process tool where there is sufficient space for the system and anywhere a robotic wafer handler may fit such that a specimen may be moved between a process chamber and the system.

Please replace the paragraph beginning at page 155, line 13 with the following rewritten paragraph:

A deposition tool may be configured for chemical vapor deposition, as described below, or for physical vapor deposition. Physical vapor deposition may commonly be used in the semiconductor industry to form a layer of a conductive material upon a specimen such as a wafer. A physical vapor deposition tool may include a vacuum process chamber in which argon ions may be generated. In addition, a support device may be disposed within the process chamber. The support device may be configured to support a specimen during a physical vapor deposition process. In addition, a circular-shaped metal target may be disposed above the support device. The physical vapor deposition tool may also include an annular metal coil interposed between the support device and the metal target. The

annular metal coil may be made of the same material as the metal target. A physical vapor deposition tool may also include a voltage controller configured to supply a voltage to the metal target, the metal coil, and the support device. The voltage controller may be further configured to generate voltage biases between the metal target and the support device and between the support device and the metal coil. The voltage biases may cause argon ions to bombard the metal target and the metal coil to release metal atoms, which may then sputter onto a surface of a specimen on the support device. Examples of physical vapor deposition systems and methods are illustrated in U.S. Patent Nos. 5,754,297 to Nulman, 5,935,397 to Masterson, 6,039,848 to Moslehi et al., 6,080,287 to Drewery et al., and 6,099,705 to Chen et al., and are incorporated by reference as if fully set forth herein.

Please replace the paragraph beginning at page 157, line 16 with the following rewritten paragraph:

As described herein, a system may be coupled to a plating tool. For example, the system may be disposed within a measurement chamber. The measurement chamber may be configured as described herein. The measurement chamber may be located proximate a process chamber of the plating tool. Alternatively, the system may be coupled to a process chamber of the plating tool. Therefore, the system may be configured to determine at least two properties of a specimen prior to, during, or subsequent to a plating process. Such arrangements of a system and a process chamber are described with reference to and illustrated in, for example, Figs. 17 and 18. Process chambers 180 and 188, as illustrated in Figs. 17 and 18, may be configured differently than shown such that the process chamber may be configured for a ~~physical vapor deposition~~ plating process. For example, process chamber 180 may not include dispense system 186 and, instead, may include various devices and components as described above. In addition, a system may be coupled to a wafer handler of a plating tool as described herein. As such, a system may be configured to determine at least two properties of a specimen while a specimen is being disposed within or removed from a process chamber of a plating tool.

Please replace the paragraph beginning at page 165, line 20 with the following rewritten paragraph:

In an embodiment, a system configured to evaluate an ion implantation process as described herein may be coupled to an ion implanter. The system may include a measurement device as described herein. The measurement device may be coupled to a process chamber of the ion implanter as shown, for example, in Fig. 17. The measurement device may be coupled to the ion implanter such that the

measurement device may be external to the ion implanter. In this manner, exposure of the components of the measurement device to chemical and physical conditions within the ion implanter may be reduced, and even eliminated. Furthermore, the device may be externally coupled to the ion implanter such that the measurement device does not interfere with the operation, performance, or control of the ion implantation process.

Please replace the paragraph beginning at page 167, line 8 with the following rewritten paragraph:

In an additional embodiment, the system may be configured to monitor or measure variations in at least one optical property of the implanted masking material. For example, the measurement device may be configured to measure an optical property of the implanted masking material substantially continuously or at predetermined time intervals during an ion implantation process. The processor may, therefore, receive one or more output signals from the measurement device that may be ~~representation~~ representative of light returned from the specimen. The processor may also monitor variations in the one or more output signals over the duration of the ion implantation process. By analyzing variations in the one or more output signals during implantation, the processor may also generate a signature representative of the implantation of the ions into the masking material. The signature may include at least one singularity that may be characteristic of an endpoint of the ion implantation process. An appropriate endpoint for an ion implantation process may be a predetermined concentration of ions in a masking material or in a specimen. In addition, the predetermined concentration of ions may vary depending upon the semiconductor device feature being fabricated by the ion implantation process. After the processor has detected the singularity of the signature, the processor may stop the implantation of ions by altering a level of a parameter of an instrument coupled to the ion implanter.

Please replace the paragraph beginning at page 167, line 27 with the following rewritten paragraph:

In an embodiment, a method for fabricating a semiconductor device may include implanting ions into a masking material and a semiconductor substrate. The masking material may be arranged on the semiconductor substrate such that predetermined regions of the semiconductor substrate may be implanted with ions. For example, portions of the masking material may be removed by a lithography process and/or etch process to expose regions of the semiconductor substrate to an implantation process. During an ion implantation process, typically, an entire ~~scanned~~ semiconductor substrate may be scanned

with a beam of dopant ions. Therefore, the remaining portions of masking material may inhibit the passage of dopant ions into underlying regions of the semiconductor substrate during an ion implantation process. As such, patterning the masking material may provide selective implantation of ions into exposed regions of the specimen.

Please replace the paragraph beginning at page 169, line 22 with the following rewritten paragraph:

In another embodiment, the masking material may include two or more layers of different masking materials arranged in a stack. For example, the masking material may include a resist formed upon an inorganic material. The inorganic material may ~~be~~ include any material that inhibits the implantation of ions through the masking material. When used as part of a masking material, the inorganic material may not be transparent or may not exhibit any substantial changes in optical properties when exposed to ions. The subsequent optical analysis may be done on the overlying resist material rather than on the underlying inorganic masking material. The inorganic material may be formed on a specimen prior to coating the specimen with a resist. This additional inorganic material, in combination with an overlying resist, may serve as the masking stack. An appropriate masking material may vary depending on, for example, an ion implantation process or an ion implanter configuration.

Please replace the paragraph beginning at page 172, line 9 with the following rewritten paragraph:

In an embodiment, the measured optical properties of the implanted masking material may be used to determine processing conditions for subsequent ion implantation processes of additional specimens such as additional semiconductor substrates or semiconductor device product wafers. For example, the implant energy of the implantation of ions into the masking material may be determined using the measured optical property of the implanted masking material. The determined implant energy may be used to determine depth of an implanted portion of a semiconductor substrate during an ion implantation process. The depth of the implanted portion of the semiconductor substrate may also be determined from a measured optical ~~properties~~ <u>property</u> of the implanted portion of the semiconductor substrate.

Please replace the paragraph beginning at page 173, line 19 with the following rewritten paragraph:

The determined depth of the implanted portion of the semiconductor substrate may be greater than a predetermined depth. Process conditions of an annealing process performed subsequent to the ion implantation process, however, may be optimized for the predetermined depth. Therefore, before annealing an implanted semiconductor substrates having the determined depth, a process condition of the annealing process such as anneal time or anneal temperature may be altered. In this example, the anneal time of the annealing process may be increased to ensure substantially complete recrystallization of the amorphous layer formed in the semiconductor substrate by the ion implantation process. In this manner, measured optical properties of a masking material may be used to determine process conditions of a semiconductor fabrication process performed subsequent to an ion implantation process using a feedforward control technique. Measured optical properties of an implanted portion of a semiconductor substrate may also be used to determine process conditions of a semiconductor fabrication process performed subsequent to an ion implantation process using a feedforward control technique.

Please replace the paragraph beginning at page 175, line 25 with the following rewritten paragraph:

In one embodiment, a laser pulse of radiation may be applied to a first surface area of a specimen to non-destructively generate an elastic pulse in the specimen. The elastic pulse may cause the first surface area to move. The acoustic pulse device may include an interferometer configured to detect an acoustic echo of the pulse traversing the specimen. The interferometer may also be configured to provide a pair of pulses including a probe pulse and a reference pulse of radiation. The interferometer may be further configured to direct the probe pulse to the first surface area when it is moved by the elastic pulse and a reference pulse to a second surface area. The second surface area may be laterally spaced from the first surface area. The interferometer may also be configured to monitor the reflection of the pulses off of the surface of the specimen. The reflection of the pair of pulses may be used to determine a thickness of a layer on the specimen. For example, a processor of the system may be configured to determine a thickness of the layer using one or more output signals from the interferometer.

Please replace the paragraph beginning at page 176, line 11 with the following rewritten paragraph:

In an embodiment, a method for non-destructively measuring properties of a specimen may include directing a pump pulse of radiation to a first surface area of the specimen to non-destructively generate an elastic pulse in the specimen. The generated elastic pulse may cause the first surface area to move. The method may also include directing a probe pulse and a reference pulse of radiation to the specimen using an interferometer. Directing the probe and reference pulses may include directing the probe pulse to the first surface area when it is moved by the elastic pulse and directing the reference pulse to a second surface area. The second surface area may be laterally spaced from the first surface area. In addition, the method may include monitoring reflections of the probe and reference pulses. The method may also include ~~determine~~ determining a thickness of a layer on the specimen. Both of the above described acoustic-pulse methods are described in further detail in U.S. Patent No. 6,108,087 to Nikoonahad et al. and U.S. Patent Application Serial No. 09/310,017, both of which are incorporated by reference as if fully set forth herein. Other methods for measuring films using acoustic waves are also described in U.S. Patent No. 6,108,087.

Please replace the paragraph beginning at page 184, line 1 with the following rewritten paragraph:

A system including an eddy current measurement device and a spectroscopic ellipsometer may be coupled to a process tool such as an atomic layer deposition ("ALD") tool. ALD may be used to form a barrier layer and/or a seat. ALD may typically be a technique for depositing thin films that may involve separating individual reactants and taking advantage of the phenomenon of surface adsorption. For example, when a specimen is exposed to a gas, the specimen may be coated with a layer of the gas. Upon removing the gas, for example, by pumping the gas out of the process chamber with a vacuum pump, under certain circumstances a monolayer of the gas may remain on a surface of the specimen. At relatively moderate temperatures (i.e., room temperature), the monolayer may be held relatively weakly on the surface of the specimen by physical adsorption forces. At higher temperatures, a surface chemical reaction may occur, and the gas may be held relatively strongly on the surface of the specimen by chemisorption forces. A second reactant may be introduced to the process chamber such that the second reactant may react with the adsorbed monolayer to form a layer of solid film. In this manner, relatively thin solid films such as barrier layers may be grown one monolayer at a time. In addition, such thin solid films may be amorphous, polycrystalline, or epitaxial depending on, for example, the specific process.

Please replace the paragraph beginning at page 185, line 20 with the following rewritten paragraph:

In an alternative embodiment, measurement device 238 may be disposed in a measurement chamber, as described with respect to and shown in Fig. 16. The measurement chamber may be coupled to deposition tool 240, as shown in Fig. 17. For example, the measurement chamber may be disposed laterally or vertically proximate one or more process chambers of deposition tool 240. For example, the deposition tool may include a cluster of process chambers that may each be configured to perform substantially similar processes or different processes. In addition, the measurement chamber may be disposed laterally or vertically proximate a load chamber of deposition tool 240. A load chamber of a deposition tool may be configured to support multiple ~~specimen~~ specimens such as a cassette of wafers that are to be processed in the deposition tool. A robotic wafer handler may be configured to remove a specimen from the load chamber prior to processing and to dispose a processed specimen into the load chamber. Furthermore, the measurement chamber may be disposed in other locations proximate a deposition tool such as anywhere proximate the deposition tool where there is sufficient space for the system and anywhere a robotic wafer handler may fit such that a specimen may be moved between a process chamber and the system.

Please replace the paragraph beginning at page 187, line 10 with the following rewritten paragraph:

The relatively small sections of substantially optically transparent material 242 may be configured to transmit light from light source 254 of first illumination system 244 outside the process chamber to a surface of specimen 246 within the process chamber and to transmit light propagating from the surface of the specimen to detector 256 outside the process chamber. In addition, relatively small sections of substantially optically transparent material 242 may be configured to transmit light from light source 258 of second illumination system 250 outside the process chamber to a surface of specimen 246 within the process chamber and to transmit light propagating from the surface of the specimen to detectors 260 and 262 outside the process chamber. The substantially optically transparent material may have optical or material properties such that the light from light sources 254 and 258 and the light propagating from a surface of specimen 246 may pass through relatively small sections 242 disposed within process chamber without undesirably altering the optical properties of the directed and returned light. In addition, the substantially optically transparent material may be configured to focus light from light sources 254 and 258 onto the surface of ~~semiconductor~~ specimen 246. In this manner, measurement

device 238 may be coupled to stage 264 disposed within the process chamber. Stage 264 may be configured as described herein.

Please replace the paragraph beginning at page 193, line 20 with the following rewritten paragraph:

In an embodiment, a processor coupled to a measurement device, as shown in Fig. 23, may be configured to determine a property of a layer formed on a specimen from detected light. The measurement device may be configured as described in above embodiments. The property of the formed layer may include, but is not limited to, a thickness, an index of refraction, an extinction coefficient, a critical dimension, or any combination thereof. Subsequent to a deposition process, the specimen may be polished such that an upper surface of the deposited material may be substantially planar. Subsequent to polishing, a layer of resist may be formed on the deposited layer and the layer of resist may be exposed to pattern the resist during a lithography process. In this manner, selected regions of the deposited layer may be exposed, and at least a portion of the selected regions may be removed in an etch process. A conductive material such as aluminum or copper may be deposited in the etched portions of the deposited layer and on an upper surface of the deposited layer, for example, by a physical vapor deposition process. The specimen may be polished such that an upper surface of the specimen may be substantially planar. In this manner, a number of semiconductor features such as interlevel contact structures may be formed on the specimen.

Please replace the paragraph beginning at page 196, line 7 with the following rewritten paragraph:

In an embodiment, processor 270 may be configured to use one or more output signals from measurement device 238 to determine a parameter of one or more instruments coupled to deposition tool 240 for deposition of layers on additional specimens. For example, a thickness of a layer on a specimen may be determined using one or more output signals from measurement device 238. The thickness of the layer on the specimen may be greater than a predetermined thickness. Therefore, before processing additional specimens, a flow rate of a reactant gas or another parameter of one or more instruments coupled to the deposition tool may be altered. In this manner, a thickness of layers formed on the additional specimens may be closer to the predetermined thickness than the measured layer. For example, the flow rate of the reactant gas used in the deposition process may be decreased to deposit a thinner ~~the~~ layer on the additional specimens. In this manner, the processor may be used to alter a parameter of one

or more instruments coupled to a deposition tool in response to one or more output signals of the measurement device using a feedback control technique.

Please replace the paragraph beginning at page 198, line 19 with the following rewritten paragraph:

In additional embodiments, the method for determining a characteristic of a layer on a specimen during a deposition process may include steps of any methods as described herein. For example, the method may include altering a parameter of an instrument coupled to the deposition tool in response to one or more output signals responsive to an intensity and/or a polarization state of the detected light. In this manner, the method may include altering a parameter of an instrument coupled to the deposition tool using a feedback control technique, an in situ control technique, or a feedforward control technique. In addition, the method may include altering a parameter of an instrument coupled to the measurement device in response to the one or more output signals. For example, the method may include altering a sampling frequency of the measurement device in response to the one or more output signals. Furthermore, the method may include obtaining a signature characterizing deposition of a layer on the specimen. The signature may include at least one singularity representative of an endpoint of the deposition process. For example, an appropriate endpoint for ~~an~~ a deposition process may be a predetermined thickness of a layer formed on the specimen. In addition, the predetermined thickness may be larger or smaller depending upon, for example, the semiconductor device feature fabricated by the deposition process. Subsequent to obtaining the singularity representative of the endpoint, the method may include altering a parameter of an instrument coupled to the deposition tool to reduce, and even terminate, the deposition process.

Please replace the paragraph beginning at page 199, line 12 with the following rewritten paragraph:

In an embodiment, a computer-implemented method may be used to control a system configured to determine a characteristic of a layer during a deposition process. The system may include a measurement device coupled to ~~an~~ a deposition tool, as described herein. The method may include controlling the measurement device. Controlling the measurement device may include controlling a light source to direct light to a surface of the specimen such that the directed light may strike the surface of the specimen. The directed light may have a known polarization state. In addition, controlling the measurement device may include controlling a detector to detect light propagating from the surface of the

specimen during the deposition process. Furthermore, the method may include processing the detected light to determine an intensity or a polarization state of the detected light. For example, the method may include processing the detected light ~~may include~~ and generating one or more output signals responsive to the detected light. The method may further include determining one or more characteristics of a layer being formed on the specimen using the one or more output signals. The one or more characteristics may include a thickness, an index of refraction, and an extinction coefficient of the layer on the specimen, a critical dimension of a feature on the specimen, a presence of defects on the specimen, or any combination thereof.

Please replace the paragraph beginning at 206, line 2 with the following rewritten paragraph:

In an alternative embodiment, light returned from the specimen may pass through quarter-wave plate 294. The quarter-wave plate may be configured to retard the phase of one of the polarization states of the returned light by about 90 degrees. In such a measurement device, polarizer 290 may be configured to cause the two polarization states to interfere. Detector 292 for such a measurement device may include a quad-cell detector having four quadrants. Each quadrant of the detector may be configured to generate one or more output signals approximately proportional to the magnitude of the power of the returned light striking the quadrant of the detector. Each signal may represent an integration of the intensities of the returned light at different angles of incidence. Such a quad-cell detector may also be configured to operate as a full power detector if the one or more output signals from all of the quadrants ~~is~~ are summed.

Please replace the paragraph beginning at page 207, line 6 with the following rewritten paragraph:

The measurement device may also include a grating (not shown) configured to focus the returned light such that light from all angles of incidence may be combined and to angularly disperse the returned light as a function of wavelength. The grating may include a curved grating and a curved mirror, a lens and a separate planar grating, or a prism. Detector 292 may include an array of a plurality of individual detector elements. In this manner, the detector may be configured to measure an intensity of returned light over a narrow wavelength regime and a number of ~~angle~~ angles of ~~incidences~~ incidence. As such, the spatial filter, the grating, and the detector may have a configuration substantially similar to a conventional spectrophotometer.

Please replace the paragraph beginning at page 211, line 11 with the following rewritten paragraph:

In an additional embodiment, the measurement device may be configured, as described above, to measure variations in the intensity of light returned from the specimen during an etch process. For example, the measurement device may be configured to measure the intensity of light returned from the specimen substantially continuously or at predetermined time intervals during an etch process. The processor may, therefore, receive output signals responsive ~~of~~ to the intensity of light returned from the specimen from the measurement device and may monitor variations in the output signals during an etch process. In addition, processor 296 may be configured to determine a relationship between the output signals from measurement device 272 and a parameter of one or more instruments coupled to process chamber 274. As such, processor 296 may be configured to alter a parameter of one or more instruments coupled to process chamber 274 in response to the determined relationship. In addition, the processor may be configured to determine a parameter of the instrument using the relationship and one or more output signals from the measurement device.

Please replace the paragraph beginning at page 215, line 15 with the following rewritten paragraph:

In additional embodiments, the method for determining a characteristic of a layer on a specimen during an etch process may include any steps of the embodiments as described herein. For example, the method may include altering a parameter of one or more instruments coupled to the etch tool in response to one or more output signals from the measurement device. In this manner, the method may include altering a parameter of one or more ~~instrument~~ instruments coupled to the etch tool using a feedback control technique, an in situ control technique, and/or a feedforward control technique. In addition, the method may include altering a parameter of one or more instruments coupled to the measurement device in response to one or more output signals from the measurement device. For example, the method may include altering a sampling frequency of the measurement device in response to one or more output signals from the measurement device.

Please replace the paragraph beginning at page 224, line 21 with the following rewritten paragraph:

The thickness of the upper crystalline layer and the amorphous layer may depend on a parameter of one or more ~~instrument~~ instruments coupled to the ion implanter. A parameter of one or more instruments coupled to the ion implanter may determine the process conditions of an ion implantation process. Instruments coupled to ion implanter may include, but are not limited to, gas supply 334, energy source 336, pressure valve 338, and modulator 340. Damage in the upper crystalline layer may vary depending on, for example, electronic collisions between atoms of the silicon layer and the implanted ions. Displacement damage, however, may not be produced if the ions entering the silicon layer do not have enough energy per nuclear collision to displace silicon atoms from their lattice sites. In this manner, a thickness of the upper crystalline layer may vary depending upon, for example, implant energy. Increasing the dose of ions, and in particular heavy ions, may produce an amorphous region below the upper crystalline damaged layer in which the displaced atoms per unit volume may approach the atomic density of the semiconductor. As the implant dose of an ion implantation process increases, a thickness of the amorphous layer may also increase. In this manner, the intensity variations of the reflected sample beam may be dependent upon process conditions during implantation including, but not limited to, the implant energy and dose. Therefore, processor 342 coupled to measurement device 308 may be configured to determine a parameter of an instrument coupled to ion implanter 310 from the measured intensity variations of the reflected sample beam prior to, during, and/or subsequent to ion implantation. Parameters of one or more instruments coupled to the ion implanter may define process conditions including, but not limited to, an implant energy, an implant dose, an implant species, an angle of implantation, and temperature.

Please replace the paragraph beginning at page 226, line 7 with the following rewritten paragraph:

In an additional embodiment, processor 342 may be coupled to measurement device 308 and ion implanter 310. The processor may be configured to interface with the measurement device and the ion implanter. For example, the processor may receive output signals from the ion implanter during an ion implantation process that may be representative of a parameter of one or more ~~instrument~~ instruments coupled to the ion implanter. The processor may also be configured to receive output signals from the detection system during an ion implantation process. In an additional embodiment, the measurement device may be configured to measure variations in output signals from the detection system during an ion

implantation process. For example, the measurement device may be configured to detect the reflected sample beam substantially continuously or at predetermined time intervals during implantation. The processor may, therefore, be configured to receive output signals responsive to the detected light substantially continuously or at predetermined time intervals and to monitor variations in the one or more output signals during the ion implantation process. In this manner, processor 342 may be configured to determine a relationship between the output signals responsive to the detected light and parameters of one or more instruments coupled to an ion implanter. As such, processor 342 may be configured to alter a parameter of one or more instruments in response to the determined relationship. In addition, processor 342 may be configured to determine a parameter of one or more instruments using the relationship and output signals from the measurement device.

Please replace the paragraph beginning at page 228, line 7 with the following rewritten paragraph:

In an embodiment, the processor may be configured to determine appropriate process conditions for subsequent ion implantation processes of additional specimens using output signals from the measurement device. For example, a depth of implanted ions in the specimen may be determined using the output signals. The determined depth of an implanted region of the specimen may be less than a predetermined depth. The predetermined depth may vary depending on a semiconductor device being fabricated on the specimen. Before processing additional specimens, a parameter of one or more instruments coupled to the ion implanter may be altered such that an implanted depth of the additional specimens may be closer to the predetermined depth than the implanted depth of the measured specimen. For example, the implant energy of the ion implant process may be increased to drive the ions deeper into the additional specimens. In this manner, the processor may be ~~coupled~~ configured to alter a parameter of one or more instruments coupled to an ion implanter in response to output signals from the measurement device using a feedback control technique.

Please replace the paragraph beginning at page 230, line 6 with the following rewritten paragraph:

In additional embodiments, the method for determining a characteristic of a specimen during an ion implantation process may include steps of any of the embodiments described herein. For example, the method may include altering a parameter of one or more instruments coupled to the ion implanter in response to the one or more output signals. In this manner, the method may include altering a parameter

of one or more ~~instrument~~ instruments coupled to the ion implanter using a feedback control technique, an in situ control technique, and/or a feedforward control technique. In addition, the method may include altering a parameter of one or more instruments coupled to the measurement device in response to the one or more output signals. For example, the method may include altering a sampling frequency of the measurement device in response to the one or more output signals.

Please replace the paragraph beginning at page 236, line 26 with the following rewritten paragraph:

Furthermore, detected light may include dark field light propagating along multiple dark field paths from the surface of the specimen. For example, as shown in Fig. 27, a detection system of measurement device 365 may include a plurality of detectors 366. The plurality of detectors may be positioned with respect to light source 368 such that each of the plurality of detectors may detect dark field light propagating from the surface of the specimen. In addition, the plurality of detectors may be arranged at ~~a~~ different radial and vertical positions with respect to light source 368. A system that includes measurement device 365 may be commonly referred to as a "pixel-based" inspection system. Examples of pixel-based inspection systems are illustrated in U.S. Patent Nos. 5,887,085 to Otsuka, and 6,081,325 to Leslie et al., and PCT Application No. WO 00/02037 to Smilansky et al., and are incorporated by reference as if fully set forth herein. An example of an optical inspection method and apparatus utilizing a variable angle design is illustrated in PCT Application No. WO 00/77500 A1 to Golberg et al., and is incorporated by reference as if fully set forth herein.

Please replace the paragraph beginning at page 238, line 13 with the following rewritten paragraph:

The measurement device may be further configured according to any of the embodiments described herein. In addition, the system may include an additional measurement device. The additional measurement device may include any of the measurement ~~device~~ devices as described herein.

Please replace the paragraph beginning at page 238, line 18 with the following rewritten paragraph:

In an embodiment, processor 364 coupled to measurement device 346 may be configured to determine one or more characteristics of defects on a surface of specimen 352, as shown in Fig. 26. In addition, processor 378 coupled to measurement device 365 may be configured to determine one or more characteristics of defects on one or more surfaces of specimen 370. Processor 364 and processor 378 may be similarly configured. For example, processors 364 and 378 may be configured to receive one or more output signals from detectors 360 and 362 or 366 and 376, respectively, in response to light detected by the detectors. In addition, both processors may be configured to determine at least one characteristic of defects on at least one surface of a specimen. The defects may include macro defects and/or micro defects. For example, processor 264 and processor 378 may be configured to determine at least one ~~characteristics~~ characteristic of macro defects on a front side and a back side of a specimen. In addition, one or more characteristics of defects may include, but are not limited to, a presence of defects on a surface of specimen, a type of defects on a surface of a specimen, a number of defects on a surface of a specimen, and a location of defects on a surface of a specimen. In addition, processor 364 and processor 378 may be configured to determine one or more characteristics of defects substantially simultaneously or sequentially. In this manner, further description of processor 364 may be applied equally to processor 378.

Please replace the paragraph beginning at page 241, line 4 with the following rewritten paragraph:

In an embodiment, the processor may be configured to determine parameters of one or more instruments coupled to the process tool for processing of additional specimens using output signals from the measurement device. For example, a thickness of a layer on the specimen may be determined using output signals from the measurement device. The thickness of the layer on the specimen may be greater than a predetermined thickness. The predetermined thickness may vary depending on, for example, a semiconductor device being fabricated ~~one~~ on the specimen. Before processing additional specimens, a parameter of one or more instruments coupled to the process tool may be altered such that a thickness of a layer on the additional specimens may be closer to the predetermined thickness than a thickness of the layer on the measured specimen. For example, the radio frequency power of an etch process may be increased to etch a greater thickness of the layer on the specimen. In this manner, the processor may be

used to alter a parameter of one or more instruments coupled to a process tool in response to output signals from the measurement device using a feedback control technique.

Please replace the paragraph beginning at page 247, line 12 with the following rewritten paragraph:

In addition, at least the one parameter of a process chamber may be altered such that a first portion of a specimen may be processed with a first set of process conditions during a step of the process and such that a second portion of the specimen may be processed with a second set of process conditions during the step. For example, each portion of the specimen may be a field of the specimen. In this manner, each field of the specimen may be subjected to ~~a~~ different process conditions such as, but not limited to, exposure dose and focus conditions and post exposure bake temperatures. As such, because each field of a specimen may be subjected to process conditions that may vary depending upon a measured property of the specimen, within wafer variations in critical metrics of the process may be substantially reduced, or even minimized.

Please replace the paragraph beginning at page 250, line 20 with the following rewritten paragraph:

System 70 may be arranged as a cluster tool. An example of a configuration of a cluster tool is illustrated in Fig. 14. For example, each of the measurement ~~device~~ devices described herein may be disposed in a measurement chamber. Each of the measurement ~~chamber~~ chambers may be disposed proximate one another and/or coupled to each other. In addition, system 70 may include a wafer handler. The wafer handler may include any mechanical device as described herein. The system may be configured to receive a plurality of specimen to be measured and/or inspected such as a cassette of wafers. The wafer handler may be configured to remove a specimen from the cassette prior to measurement and/or inspection and to dispose a specimen into the cassette subsequent to measurement and/or inspection. The wafer handler may also be configured to dispose a specimen within each measurement chamber and to remove a specimen from each measurement chamber. In addition, the system may include a plurality of such wafer handlers. The system may be further configured as described with reference to Fig. 14. In addition, the system may be configured as a stand-alone metrology and/or inspection system. In this manner, the system may not be coupled to a process tool. Such a system may provide advantages over a similarly configured integrated tool. For example, such a system may be designed to be faster and cheaper than a similarly configured integrated tool because there may be less

physical and mechanical constraints for a stand-alone system versus an integrated system. System 70 may be further configured as described herein.

Please replace the paragraph beginning at page 252, line 15 with the following rewritten paragraph:

In this manner, the measurement device may be configured to function as a single measurement device or as multiple measurement devices. Because multiple measurement devices may be integrated into a single measurement device of the system, at least one element of a first measurement device, for example, may also be at least one element of a second measurement device. In addition, it may be advantageous for additional elements such ~~a~~ as handling robots, stages, ~~processor~~processors, and power supplies of a first measurement device to be used by a second measurement device. The system may also include an autofocus mechanism that may be configured to bring a specimen substantially into focus (i.e., to approximately a correct height) for a first measurement device, and then for a second measurement device. An example of an autofocus mechanism is shown in Fig. 11b, as autofocus sensor 124. An additional example of an autofocusing apparatus is illustrated in U.S. Patent No. 6,172,349 to Katz et al., which is incorporated by reference as if fully set forth herein. The system, the measurement device, and the processor may be further configured as described herein.

Please replace the paragraph beginning at page 253, line 2 with the following rewritten paragraph:

Appropriate combinations of devices included in the measurement device may include, for example, a small-spot photo-acoustic device and a grazing X-ray reflectometer or a small-spot photo-acoustic device and a broadband small-spot spectroscopic ellipsometer. For example, a photo-acoustic device may provide measurements of layers having thickness of less than about a few hundred angstroms while a grazing X-ray reflectometer may ~~provided~~ provide measurements of layers having thicknesses in a range from about 50 angstroms to about 1000 angstroms. Ellipsometric techniques, especially broadband ellipsometry, may provide measurements of metal and semi-metallic layers having thicknesses of less than about 500 angstroms because at such thicknesses even metal may allow some light to pass through the layer. In addition, ellipsometric techniques may also provide measurements of transparent layers having thicknesses from about 0 angstroms to a few microns. As such, a system, as described herein, may provide measurements of layers having a broad range of thicknesses and materials.

Please replace the paragraph beginning at page 256, line 21 with the following rewritten paragraph:

The spectroscopic ellipsometer may or may not be disposed within a measurement chamber as described above. For example, in an alternative embodiment, the spectroscopic ellipsometer may be coupled to a robotic wafer handler of the lithography track. In this manner, the spectroscopic ellipsometer may be configured to direct light toward and detect light returned from the specimen prior to or subsequent to a process such as prior to exposure, subsequent to exposure, or after develop. For example, subsequent to exposure, the spectroscopic ellipsometer may be configured to generate one or more output signals responsive to a critical dimension, a profile, a thickness or other thin film characteristics of a latent image formed on the specimen by the exposure process.

Please replace the paragraph beginning at page 260, line 16 with the following rewritten paragraph:

An X-ray diffractometer may be configured to perform X-ray diffraction. X-ray diffraction involves coherent scattering of x-rays by polycrystalline materials. The x-rays are scattered by each set of lattice planes at a characteristic angle, and the scattered intensity is a function of the atoms which occupy those planes. X-ray diffraction peaks may be produced by constructive interference of a monochromatic beam scattered from each set of lattice planes at specific angles. The peak intensities are determined by atomic arrangement within the lattice planes. In this manner, the scattering from all the different sets of planes results in a pattern, which is unique to a given compound. In addition, distortions in the lattice planes due to stress, solid solution, or other effects may be ~~measure~~measured. The scattered x-rays may be detected and one or more output signals responsive to the intensity of the scattered x-rays may be generated. The one or more output signals may be used to obtain one or more properties of a layer on a specimen or a specimen. An advantage of X-ray diffraction is that it is a substantially non-destructive technique. Commercially available X-ray diffractometers are available from, for example, Siemens, Madison, Wisconsin and Rigaku USA, Inc., The Woodlands, Texas.

Please replace the paragraph beginning at page 262, line 4 with the following rewritten paragraph:

In this manner, the measurement device may be configured to function as a single measurement device or as multiple measurement devices. Because multiple measurement devices may be integrated into a single measurement device of the system, elements of a first measurement device, for example, may also be elements of a second measurement device. In addition, it may be advantageous for additional elements such ~~a~~ as handling robots, stages, ~~processor~~processors, and power supplies of a first measurement device to be used by a second measurement device. The measurement device may also include an autofocus mechanism that may be configured to bring a specimen substantially into focus (i.e., to approximately a correct height) for a first measurement device, and then for a second measurement device. The system, the measurement device, the autofocus mechanism, and the processor may be further configured as described herein.

Please replace the paragraph beginning at page 267, line 5 with the following rewritten paragraph:

In an embodiment, each of the systems described above may be coupled to ~~an~~ a secondary electron spectroscopy device. Such a system may be configured to determine material composition of a specimen by analyzing secondary electron emission from the specimen. An example of such a device is illustrated in PCT Application No. WO 00/70646 to Shachal et al., and is incorporated by reference as if fully set forth herein.

Please replace the paragraph beginning at page 268, line 4 with the following rewritten paragraph:

In addition, the stand alone metrology and/or inspection system may be coupled to a plurality of systems as described herein. In this manner, the stand alone metrology and/or inspection system may be configured to calibrate the plurality of systems coupled to the stand alone system. For example, a plurality of systems may include single tools and/or cluster tools incorporated within the same manufacturing and/or research and development facility. Each of the plurality of systems may be configured to determine ~~the same~~ at least two characteristics of a specimen. In addition, each of the plurality of systems may be configured to determine at least two characteristics of substantially the same type of specimen such as specimens upon which a substantially similar type of semiconductor device may be formed. For example, each of the plurality of systems may be incorporated into the same type of product line in a manufacturing facility.